

WE CLAIM:

1. A plastic package for use in semiconductor devices,
said package having a plurality of metallic terminals
5 exposed on a package surface, comprising:
 a metallic bump attached to each of said terminals,
 said bumps made of reflowable metal and having
 approximately uniform height; and
 an adherent layer of polymer material covering said
10 package surface and surrounding each of said
 bumps to form a solid meniscus, said layer having
 a thickness between a quarter and one half of
 said bump height.
2. The package according to Claim 1 wherein said plastic
15 is any polymeric material used in semiconductor
encapsulation, including molding compounds as well as
thermoset and thermoplastic formulations.
3. The package according to Claim 1 wherein said
semiconductor devices include any product of the ball-
20 grid array and chip-scale package families.
4. The package according to Claim 1 wherein said
reflowable metal is selected from a group consisting of
tin, indium, tin alloys including tin/indium,
tin/silver, tin/bismuth, and tin/lead, conductive
25 adhesives, and z-axis conductive materials.
5. The package according to Claim 1 wherein said bumps
have a diameter from about 50 to 700 μm and a center-
to-center spacing between about 100 and 1300 μm .
6. The package according to Claim 1 wherein said polymer
30 material for said adherent layer includes non-
electrically conductive adhesives, epoxies filled or
unfilled with inorganic particulate fillers including

boron nitride or aluminum nitride, bisphenol A with an anhydride cross-linking agent, having a viscosity of < 8000 cps and an elasticity modulus between about 1 and 5 GPa.

- 5 7. A polymeric substrate for use in electronic assembly boards, said substrate having a plurality of metallic terminals exposed on a substrate surface, comprising:
 - a metallic bump attached to each of said terminals, said bumps made of reflowable metal and having approximately uniform height; and
 - 10 an adherent layer of polymer material covering said substrate surface and surrounding each of said bumps to form a solid meniscus, said layer having a thickness between a quarter and one half of said bump height.
- 15 8. The substrate according to Claim 7 wherein said assembly board is selected from a group consisting of organic materials, including FR-4, FR-5, and BT resin, with or without strengthening or thermally modulating fibers or fillers, including a grid of glass fibers.
- 20 9. A method for completing a polymer plastic package for use in semiconductor devices, comprising the steps of:
 - providing a polymer package having a plurality of metallic terminals exposed on a package surface,
 - 25 said terminals spaced apart;
 - attaching a metallic bump to each of said terminals, said bumps made of reflowable metal and having approximately uniform mass and height;
 - reflowing said bumps, while maintaining approximate uniformity of predetermined height;
 - 30 stencil-printing a water-soluble polymer to coat the top surface of said bumps;

positioning said packages in the vacuum chamber of a plasma apparatus so that said surface faces the plasma source;

initiating a plasma and controlling the ion mean free path so that said ions reach said surface with predetermined energy;

exposing said surface to said plasma for a length of time sufficient to

- roughen said polymer surface;
- clean said polymer surface from organic contamination; and
- improve the surface affinity to adhesion;

removing said package from said vacuum chamber;

distributing an adherent polymeric precursor between and around said bumps, to form a meniscus on each of said bumps and to fill said space between said bumps by a layer having a thickness between a quarter and one half of said height of said bumps;

supplying additional thermal energy for curing said polymeric precursor, whereby said layer and said meniscus solidify;

cooling the package to ambient temperature; and

washing said package in DI water to remove said

water-soluble polymeric bump coating, completing said plastic package.

10. The method according to Claim 9 wherein said water-soluble polymer is polyvinyl alcohol.

11. The method according to Claim 9 further comprising the process step of slightly polishing said bump surfaces before said step of washing to remove excess polymer.